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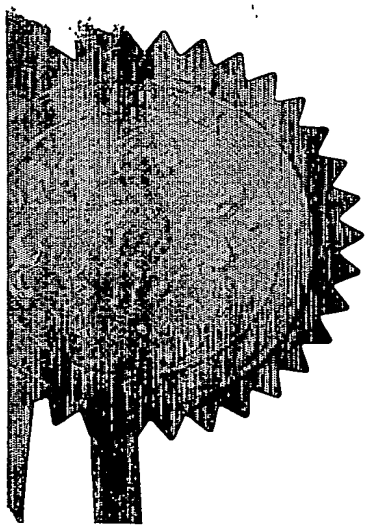

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Request for grant of a patent

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1. Your reference — RCA/44191.GB01 — 28 JUN 2002

2. Patent application number *(The Patent Office will fill in t* — 0215040.7 — 01JUL02 E729634-1 D01631 P01/7700 0.00-0215040.7

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

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Patents ADP number *(if you know it)* 8316937001

If the applicant is a corporate body, give the country/state of incorporation — United Kingdom

4. Title of the invention

An improved method and apparatus for providing an anti-copy video signal.

5. Full name, address and postcode in the United Kingdom to which all correspondence relating to this form and translation should be sent

Reddie & Grose
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WC1X 8PL

Patents ADP number *(if you know it)* 91001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application *(If you know it)*	Date of filing *(day/month/year)*

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Number of earlier application	Date of filing *(day/month/year)*

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Claim(s)	13
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11. I/We request the grant of a patent on the basis of this application.

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AN IMPROVED METHOD AND APPARATUS FOR PROVIDING AN ANTI-COPY VIDEO SIGNAL

This invention relates to an improved method and apparatus for providing an anti-copy video signal, in particular a video signal that has application in the field of pay-per-view television.

It is desirable for producers of video programmes, whether recorded on video cassette or broadcast, to be able to provide a signal that when received by a television receiver or display device can be viewed, but which once copied, cannot be satisfactorily viewed on the television receiver or display device. Such a signal allows broadcasters and video content producers to protect themselves against loss of revenue resulting from unauthorised copying of their signal. In the case of producers of pre-recorded video cassettes, unauthorised copying is video piracy, that is copying from one video cassette to another video cassette illegally. Often video piracy is committed with a view to selling the illegally made copies of films to the public.

In the case of broadcasters however, in particular pay-per-view TV distributors, unauthorised copying may simply be the recording of a video signal legitimately received at a digital set top box in the home onto a video cassette. Protection against this type of copying provides further advantages to the broadcasters than simply protecting against loss of revenue. By preventing unauthorised copy in the home, the broadcaster can protect the interests of the producer of the video programmes

while still allowing the programme to be viewed in the home. Thus, a broadcaster may for example obtain a special agreement from a movie distributor to broadcast a movie before the movie's general video release date, allowing the broadcaster to enjoy increased rating figures, while protecting the revenue in subsequent video sales for the movie.

Various methods for modifying a video signal are known, such that when the modified signal is recorded by a video cassette recorder the recorded signal is unwatchable. However, the efficacy of such modified signals varies widely depending upon the television receiver and video recorder used to display and record the signal. We have appreciated therefore that it would be advantageous to provide an improved signal having an anti-copy effect on a wide range of television receivers and recording devices, such as video recorders.

SUMMARY OF THE INVENTION

The invention is claimed in the independent claims to which reference should now be made. Advantageous features are set forth in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail by way of example and with reference to the drawings in which:

Figure 1 illustrates a part of a known television picture signal;

Figure 2 illustrates a line of the video picture signal shown in Figure 1;

Figure 3 illustrates a line of the video picture signal, according to the preferred embodiment of the invention;

Figure 4 illustrates the addition of pulses to the modified video picture signal shown in Figure 2, and throughout the vertical blanking section of the picture signal, as well as the addition of a modulated wave-from into the vertical synchronisation pulses, according to the preferred embodiment of the invention;

Figure 5 illustrates the addition of a modulation signal prior to the vertical blanking section of the video picture signal shown in Figure 1, according to the preferred embodiment of the invention;

Figure 6 is a schematic illustration of apparatus for generating the modified wave form according to the preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows a region of a known video picture signal 1, such as a phase-alternating-line (PAL) signal. The signal comprises synchronisation information 2 for initialising the circuits of a television receiver and picture information 4. The information is arranged into 625 lines 6 which correspond to one full screen of a picture called a frame. There are 625 lines in a PAL signal making up a single frame, and each line of the signal has a length of 64μs.

The picture information is displayed on a screen of a television receiver using an electron gun to sweep an

electron beam across the screen from the left to the right in a single line. The electron beam also sweeps from the top of the screen to the bottom of the screen to display the lines of the picture signal, and does this twice for a PAL signal. In the first sweep, the odd numbered lines are displayed, after which the electron beam returns to the top to display the even numbered lines. Each pattern of lines displayed on the screen is called a raster and there are therefore two rasters in one frame of a PAL signal.

The picture information 4 comprises a positive going wave-form 8, the height of which above the zero-level of the video signal represents the colour to be displayed at a corresponding point on a line of the screen of the television receiver. The zero-level of the signal is called the blanking level and corresponds to the colour black displayed on the screen. Once a line of picture information has been projected on to the television screen, the electron beam must be reset to the left of the screen before the next line can be displayed. This is achieved by negative-going line synchronisation pulses 10, each of width 4.7μs. A line synchronisation pulse 10 is positioned at the end of each line, after any picture information 8.

The video picture signal contains more lines than are usually displayed on the screen of a television receiver; not all lines of the signal are used to display picture information. In particular, two regions of blank lines are provided in the PAL signal in order to control the fly-back of the electron beam from the bottom of the screen to the top, after all of the odd or even numbered lines have been displayed. These regions are called

vertical blanking regions 12 and each contains a number of synchronisation pulses which are used to reset the television receiver so that it is ready to display the next frame of picture information. The vertical blanking region contains a series of pre-equalisation pulses 14, vertical synchronisation pulses 16 and post-equalisation pulses 18. The vertical synchronisation pulses 16 are detected in the television receiver by an arrangement of capacitors that build up charge as each vertical synchronisation pulse is received. The spacing of the vertical synchronisation pulses, and the width of the pulses is such that the charge on the capacitors increases until a threshold level is reached, triggering fly-back of the electron beam from the bottom of the television screen to the top. The pre-equalisation pulses 14, and post-equalisation pulses 18 however are spaced such that the charge on the arrangement of capacitors is reset before and after the vertical synchronisation pulses are received. This ensures reliable detection of the vertical synchronisation pulses and reliable fly-back of the electron beam to start a new raster. Only one vertical blanking region is shown in Figure 1.

A modified picture signal according to the preferred embodiment of the invention will now be described. The modified signal comprises an additional positive going pulses added to each line of the signal throughout both the visible picture region and throughout the vertical blanking region 12. Furthermore, the modified signal comprises a first modulated wave-form added to the vertical synchronisation pulses and a second modulated wave-form added to several lines of the picture signal before the vertical blanking section. The second modulated

wave-form replaces the picture information 8 of those lines. The presence of all three of these features together has been found to be provide a surprising accumulative effectiveness in causing interference in the reproduction of the modified video signal during playback of the copied video signal, that is greater than the effectiveness provided by the different features taken separately. Indeed the presence of just one of the features alone is not sufficient to result in interference in the reproduction of the copied modified video signal when it is played back. The presence of one of the features therefore increases the effectiveness of the other features, resulting in enhanced overall effect.

As well as an unexpected increased effectiveness, the modified video signal provides increased protection against any measures that might prevent the modified video signal from having an effect. Even if a television receiver is not susceptible to one of the anti-copy features, the presence of the other two are still likely to have a disruptive effect. For this reason, it is preferred if the features are added to the video signal such that the presence of two of them is enough to cause interference during playback of the copied signal.

Furthermore, if any apparatus is developed to deliberately overcome the protection provided by the preferred anti-copy video signal, it must compensate for three anti-copy features in the modified video signal not just one. If the dimensions of the features are varied from line to line or frame to frame, as described later, the three anti-copy features are even more difficult to negate.

Furthermore, the modulated picture signal according to the preferred embodiment of the invention comprises picture information 8 that has been amplified in comparison to the unmodified signal shown in figure 1.

Each of the features of the modified video signal will now be described in more detail with reference to Figures 2 to 6. Figure 2 shows a single line 6 in the picture region of the picture signal 1 shown in Figure 1. The line is 64μs in length and comprises positive-going wave form 8 defining picture information and horizontal blanking section 20. The picture information of the line is known as the active line and is 52μs in length. The horizontal blanking section is therefore 12μs in length. It does not contain picture information and is not displayed on the screen of the television receiver, but does include synchronisation information and other information for regulating the response of the television receiver circuits. In particular, the horizontal blanking section 20 includes a horizontal or line synchronisation pulse 10 for controlling the line flyback circuits of the television receiver, and colour burst portion 22 for initialising the colour response of the television receiver to the picture signal. The horizontal line pulse is 4.7μs in width and extends to -300mV below the blanking level.

The region of the horizontal blanking section 20 to the left in the diagram of the horizontal line pulse 10 is called the front porch 24, while the region extending to the right of the horizontal line synchronisation pulse is called the back porch 26. The back porch extends to the start of the picture information 8.

Figure 3 shows the corresponding region of the modified video picture signal according to the preferred embodiment of the invention for providing an anti-copy effect. The modified signal comprises a positive-going pulse 28 added to the horizontal blanking section at the beginning of the back porch 26. Preferably the height of the additional pulse 28 is 1V above the blanking level, but any height in the range 0.5V to 1.5V has been found to be acceptable. The maximum height of the picture information wave-form 8 is about 0.7V. The pulse is added to each line 6 of the modified video signal.

The additional pulse 28 preferably has a width of 1.2μs and is situated such that it extends 0.8μs into the horizontal line synchronisation pulse 10. Thus, the effective width of the line synchronisation pulse is reduced from 4.7μs to 3.9μs. The original position of the rising edge of the horizontal synchronisation pulse 10 is shown in Figures 2 and 3 by the dotted line 30.

The width of the additional pulse and the position in the blanking signal at which it is positioned may however be varied. As particular television receivers may be less susceptible to the effect of the additional pulses if the pulse is maintained at a particular height and at a particular position, it is preferred if the position, and height and width of the pulse are varied throughout the picture signal and indeed even from line to line. This ensures that the effect of the additional pulse 28 is likely to be encountered on a range of different television receivers despite their different responses to the recorded video signal.

The additional pulse has been found to produce satisfactory results providing it has a width in the range

0.2μs and 4μs. It has also been found that the position of the pulse can be varied such that the width of the horizontal line pulse is reduced up to 2μs from line 30.

The effect of the pulse inserted into the horizontal blanking region is to interfere with the operation of the Automatic Gain Control (AGC) circuits of a video recorder. The AGC circuits of the video recorder typically detect the height of the synchronisation pulses in the received signal and amplify the signal so that it is at a suitable level to be recorded. The AGC circuits therefore compensate for any attenuation in the video picture signal when it is received at the video recorder.

The pulse 28 is to present a rising or falling edge of greater amplitude than the synchronisation pulse in the region where the ACG circuits sample the signal to detect the synchronisation pulse. The automatic gain control circuits are caused therefore to underestimate the amount by which the signal needs to be amplified in order to ensure that the picture quality is at a suitable level for recording. The synchronisation pulses are not therefore amplified sufficiently to achieve reliable synchronisation on a television receiver when the signal is viewed and as a result the playback quality is reduced. Apparatus and systems that work in this way are well known in the art and shall not be described further here.

However, the pulse that is added in the preferred embodiment, has the additional effect of reducing the width of the horizontal line synchronisation pulse. Before recording, the reduction in width of the horizontal line synchronisation pulses 10 is not sufficient to affect the display of the picture information. However, after recording of the signal has taken place on a video

cassette recorder, the reduction in width is combined with the reduction in height of the horizontal synchronisation pulse that results from insufficient amplification by the AGC circuits. This causes the line synchronisation pulses to be even less likely to be reliably detected by the television receiver.

Reference shall now be made to Figure 4, the upper half of which shows a number of lines in the vertical blanking region 12 of the picture signal shown in Figure 1. The five vertical synchronisation pulses 16 can be seen to extend negatively from the blanking level 32.

The modified video signal according to the preferred embodiment of the invention, is shown in the bottom half of the figure. It comprises a modulated wave-form 34 that is added into the width of the vertical synchronisation pulses. The modulated wave-form is preferably a square wave of frequency 400kHz, which extends from the peak minimum level of the vertical synchronisation pulses to a height of about 250mV above the blanking level 32. Heights of the first modulated waveform 34 in the range of 150mV to 400mV have been found to work well.

Other wave-forms, such as a sine-wave or a saw-tooth wave for example, could also be used. Furthermore, it has been found that the frequency of the modulated wave-from can be varied from 100kHz to 6.5MHz.

The effect of the modulated wave-from is to partially cancel out the vertical synchronisation pulses 16 making them harder to detect in the television receiver. Before the modified video signal is recorded, the height of the modulation is not sufficient to have an effect on the display of the modified signal. During recording however, the video signal is amplified according to an amount

determined by the AGC circuits of the video recorder. The maximum amplitude of the negative-going synchronisation pulses is clamped at a value of approximately -300mv relative to the blanking level to ensure that the synchronisation pulses of the recorded signal are suitable for detection by a television receiver. As a result of the clamping in the negative region of the signal, the positive region of the signal is amplified with respect to the negative region. This amplification of the positive part of the signal during recording has the effect of amplifying the positive part of the modulated wave-form, thereby cancelling more of the vertical synchronisation pulse.

This can also be understood from a consideration of the average voltage level of the vertical synchronisation pulse. After recording the average voltage level of the vertical synchronisation pulses 16 comprising the modulation is higher than the average voltage level before recording, owing to the recording-induced-increase in the maximum positive amplitude of the modulation.

As a result, the capacitor arrangement in the television receiver which detects the vertical synchronisation pulse may not be able to charge beyond the threshold level as quickly as before, or even at all before the last vertical synchronisation pulse is received. The television receiver is more likely therefore to experience difficulty in synchronising fly-back between frames. This will cause the picture displayed on the screen of the television receiver to jump and jitter making it unpleasant to watch. The effect of these pulses, may be realised after a single recording, or after several recordings depending upon the amount of amplification.

Even if a first unauthorised recording of the modified video signal is successfully made, in which the height of the pulses is insufficient to have an effect, subsequent recordings will raise the height of the pulses to a level at which it is likely to have an effect.

It can be seen from this figure that the additional pulse 28 is inserted not just in the picture region but at every line of the video picture signal including those in the vertical blanking region. The additional pulses 28 inserted into the vertical blanking region add to the effect of the modulation 34 by further partially cancelling the vertical synchronisation pulses. The effect of these additional pulses is also increased by recording of the signal.

Figure 5 to which reference should now be made shows in more detail another feature of the modified video picture signal in a preferred embodiment. Lines of picture information 8 prior to the vertical blanking section 12 of the picture signal are removed and replaced by a modulated wave form 36. Though these lines contain picture information, they are not normally within the visible region displayed on the screen and can therefore be manipulated without any material loss in picture quality.

An unmodified video signal is shown in the bottom half of Figure 5 by way of comparison.

The modulated wave form 36 is preferably centred about the DC level and has an amplitude in the range 40 to 150 mV, that is a peak-to-peak amplitude of 80mV to 300mV. A preferred amplitude has been found to be 80mV. The frequency of the modulated wave is preferably in the range 10kHz to 2 MHZ, but a frequency of 220kHz has been found to be favourable in practice. The pulse 28 which is added

to the lines of the picture signal is not shown in Figure 5 for the sake of clarity.

Although a square wave form is shown in Figure 5, it will be appreciated that alternative wave forms such as a sine wave or saw-tooth waves may also be used. Preferably, the modulated wave-form is added to 12 lines of picture information at the bottom of the picture signal before the vertical blanking region. In practice it has been found that the wave-form may be added to just 5 lines or up to 15 lines. If more than 15 lines are modified in this way, it is possible that the modulation may become visible on the television screen of the television receiver.

The effect of inserting the modulated wave-form into the lines of picture information is to cause the voltage level in the recorded video signal in the region of modulated wave-form to fall off with time. As a result, the signal may drop to a level where it is mistaken for a synchronisation pulse, causing the television receiver to experience difficulty in synchronising the recorded signal on playback.

As described earlier, the modified video picture signal according to the preferred embodiment of the invention, comprises amplified video picture information 8, in comparison to the unmodified video picture signal shown in Figure 1. It has been found advantageous to amplify the picture information because of the increase in the dc level of the modified video signal caused by the additional pulses 22. As a result of this increase, the amplitude of the video picture information appears smaller in comparison. The AGC circuits of the television receiver do not therefore amplify the signal by a sufficient amount and as a result the modified picture video signal

appears dark when viewed on a television receiver even if it has not been recorded.

The picture information in the preferred embodiment is therefore amplified, after the additional pulses, and the first and second modulated wave-form have been added to a signal to produce a modified signal. Preferably, the amplification is achieved by adding 100mV to the picture information signal across its entire width. The amplification causes the amplitude of the picture signal to increase from a maximum value, corresponding to the peak white level, of 700mV to 800mV. Alternatively, the picture information 8 may be multiplied by a scaling factor to provide the amplification.

Only the part of the signal containing picture information, that is the active line, is amplified. The horizontal blanking interval 30, is not amplified as this contains the additional pulse 28.

The amplification applied to the signal is chosen such that the signal appears on the screen of a television receiver at an improved brightness for viewing. The change in brightness caused by the amplification will vary from television receiver to television receiver depending on its construction. Preferably, if the type of television receiver on which the modified picture signal is to be viewed is known, the amplification applied to the picture information can be provided at a level suitable for that television receiver. In the case of pay-per-view television, information about the television receiver may be collected from subscribers when they first subscribe to the service. Although, it is not necessary that they provide information about their television receiver, doing so will allow them to receive a modified video signal adjusted to be viewable at the optimum brightness for their receiver.

Figure 6 is a schematic diagram of an apparatus for generating a modified video picture signal in accordance with the preferred embodiment of the invention from an ordinary video picture signal.

Unmodified video picture signal is first received at input 40. The signal is then passed to Anti-Copy Signal Generator 42 and to Brightness Separator 44.

The Anti-copy Signals Generator generates the additional pulses 28, as well as the first and second modulated wave-forms 34 and 36 for insertion into the vertical synchronisation pulses and the lines before the vertical blanking region, and inserts the pulses and modulated wave-forms into the signal as described.

The Brightness Separator 44extracts the brightness information from the received video signal, and passes this in the form of a brightness signal to Brightness Algorithm 46 which also receives input from TV Receiver Model 48. The Brightness Algorithm determines from the TV Receiver Model the desired amount of amplification that is required for the picture information of the signal. The picture information may be amplified by the addition of a constant signal, such as 100mV as in the preferred embodiment, or by multiplying the picture information by a scaling factor.

The TV Receiver Model 48 comprises information specifying the amount of amplification required for different respective television receivers. The information may be calculated empirically, and may be stored in a look-up table for example. If the information describing the type of television receiver has been provided by a Pay-Per-View television subscriber, then the look-up table can be referred to to obtain the amplification necessary to give the optimum increase in brightness of the signal following modification for that receiver. A generic television type may be provided in the look-up table to be

used when no information about the destination television receiver of the subscriber is known, or when the destination television receiver happens not to be included in the table.

The TV Receiver Model 48 is also coupled to Anti-copy signals generator 42. As explained before the dimensions of the additional pulse 28 and first and second modulated wave-forms, such as height, width, frequency and position for example, can be altered. Different values for these figures have different effects on different television receivers. If the type of the destination television receiver on which the modified video signal is to be viewed is known, it is therefore possible to add the pulses, and modulation effects with parameters that produce the optimum effect when viewed on that television receiver. In this way the effect of the modified video signal can be tailored to suit a particular receiver. The Anti-copy signals generator therefore consults the look-up table before adding the pulses and modulations to obtain the optimum values. A generic response which comprises a range of figures for the dimensions and positions of the pulses and the dimensions of the modulated wave-forms are provided if the television receiver type is not known, or is not included in the table. The Anti-copy signals generator can then vary the dimensions and position of the pulses, and the dimensions of the modulated wave-forms within the range in order to ensure the effect of the anti-copy signals are visible on a wide range of receivers.

The amplification specified by the TV Receiver Model is applied by the Brightness Algorithm 46 to the brightness signal supplied by the Brightness separator 44. The amplified brightness signal is then passed to adder 50, which also receives the modified signal from the Anti-copy signal generator. Adder 50 adds the amplified

brightness signal into the modified video signal replacing the original brightness information in the modified video signal, to form a final modified signal which is supplied to an output 52.

It will be appreciated that the apparatus shown in Figure 6 may be implemented in software on a computer or as hardware, such as a processor.

Although, the invention has been described with reference to a video cassette recorder, the invention has equal application to DVD recorders, digital video recorders and video recorders using video capture cards.

Claims

1. A method of modifying a programme signal to provide protection against copying on a magnetic tape recorder, the method comprising the steps of:

receiving a programme signal divided into lines of information, the signal having horizontal synchronisation pulses and vertical synchronisation pulses for synchronising the programme on the screen of a receiver;

adding a pulse into the programme signal during the horizontal blanking interval of lines that contain picture information and into lines in the vertical blanking region;

adding a first modulation signal to vertical synchronisation pulses of the programme signal;

adding a second modulation signal to lines of picture information in the vicinity of the vertical blanking region at the bottom of a frame of the programme signal;

wherein the pulse, and the first and second modulation signals added to the programme signal are sufficient such that when the signal is copied by a magnetic tape recorder, interference is produced in the reproduction of the copied signal that is not visible in the reproduction of an uncopied programme signal.

2. A method according to claim 1 comprising amplifying the picture information in lines of the programme signal to increase the brightness of the signal such that the darkening effect of adding the pulse, and the first and second modulated signals is reduced.

3. A method according to claim 1 or 2 wherein the pulse is added to the horizontal blanking interval adjacent the horizontal synchronisation pulse.

4. A method according to claim 1 to 3 wherein the pulse is added to the horizontal blanking interval such that the width of the horizontal synchronisation pulse is reduced.

5. A method according to any previous claim in which the height of the pulse is in the range 0.5V to 1.5V above the blanking level.

6. A method according to any previous claim in which the height of the pulse is 1V.

7. A method according to any previous claim in which the width of the pulse is in the range 0.2µs to 4µs.

8. A method according to any previous claim in which the width of the pulse is 1.2µs.

9. A method according to any previous claim wherein the pulse is positioned such that the width of the horizontal synchronisation pulse is reduced from 0µs to 2µs.

10. A method according to any previous claim wherein the pulse is positioned such that the width of the horizontal synchronisation pulse is reduced by 0.8µs.

11. A method according to any previous claim comprising adding the pulse to the horizontal blanking interval such that one or more of the height, the width, and the position of the pulse varies across the lines of the programme signal.

12. A method according to any previous claim wherein the first modulation signal has a frequency in the range 100kHz to 6500kHz.

13. A method according to any previous claim wherein the first modulation signal has a frequency of 400kHz.

14. A method according to any previous claim wherein the height above the blanking level to which the first modulation signal extends is 250mV.

15. A method according to any previous claim wherein the first modulation signal is a square wave.

16. A method according to any previous claim wherein the first modulation signal is a sine wave.

17. A method according to any previous claim wherein the first modulation signal is a saw tooth function.

18. A method according to any previous claim wherein frequency of the first modulation signal is varied between different vertical synchronisation pulses.

19. A method according to any previous claim wherein the second modulation signal has a frequency in the range 10kHz to 2MHz.

20. A method according to any previous claim wherein the second modulation signal has a frequency of 220kHz.

21. A method according to any previous claim wherein the second modulation signal has an amplitude in the range 40mV to 150mV.

22. A method according to any previous claim wherein the second modulation signal has an amplitude of 70mV.

23. A method according to any previous claim wherein the second modulation signal is a square wave.

24. A method according to any previous claim wherein the second modulation signal is a sine wave.

25. A method according to any previous claim wherein the second modulation signal is saw tooth function.

26. A method according to any previous claim wherein the second modulation signal is added to between 5 and 15 lines of picture information prior to the vertical blanking section.

27. A method according to any previous claim wherein the second modulation signal is added to 12 lines of picture information prior to the vertical blanking section.

28. A method according to the any previous claim wherein at least one of the number of lines to which the second modulation signal is added, the amplitude of the modulation signal, and the frequency of the modulation signal is varied from frame to frame of the programme signal.

29. A method according to any previous claim wherein the pulse, and first and second modulation signals are added to the programme signal in dependence on information relating to the type of receiver on which the programme signal is to be viewed.

30. A method according to any of claims 2 to 29 wherein the picture information is amplified by adding 100mV to region of the signal comprising the picture information.

31. A method according to any of claims 2 to 29 wherein the picture information is amplified by multiplying the region of the signal comprising the picture information by a scaling factor.

32. A method according to any of claims 2 to 29 wherein the picture information is amplified by multiplying the region of the signal comprising the picture information by an amount that varies in dependence on information relating to the type of receiver on which the programme signal is to be viewed.

33. A method of modifying a programme signal to provide protection against copying on a magnetic tape recorder, the method comprising:

receiving a programme signal divided into lines of information, the signal having horizontal synchronisation pulses and vertical synchronisation pulses for synchronising the programme on the screen of a receiver; and performing two of following three steps:

adding a pulse into the programme signal during the horizontal blanking interval of lines that contain picture information and into lines in the vertical blanking region;

adding a first modulation signal to vertical synchronisation pulses of the programme signal;

adding a second modulation signal to lines of picture information in the vicinity of the vertical blanking region at the bottom of a frame of the programme signal;

wherein two of either the pulse, and the first and second modulation signals added to the programme signal are sufficient such that when the signal is copied by a magnetic tape recorder, interference is produced in the reproduction of the copied signal that is not visible in the reproduction of an uncopied programme signal.

34. Apparatus for modifying a programme signal to provide protection against copying on a magnetic tape recorder, the apparatus comprising:

an input for receiving a programme signal divided into lines of information, the signal having horizontal synchronisation pulses and vertical synchronisation pulses for synchronising the programme on the screen of a receiver;

a first adder for adding a pulse into the programme signal during the horizontal blanking interval of lines that contain picture information and into lines in the vertical blanking region;

a second adder for adding a first modulation signal to vertical synchronisation pulses of the programme signal;

a third adder for adding a second modulation signal to lines of picture information in the vicinity of the vertical blanking region at the bottom of a frame of the programme signal; and

an output for outputting a modified programme signal;

wherein the pulse, and the first and second modulation signals added to the programme signal are sufficient such that when the modified programme signal is copied by a magnetic tape recorder, interference is produced in the reproduction of the copied signal that is not visible in the reproduction of an uncopied programme signal.

35. An apparatus according to claim 34 comprising an amplifier for amplifying the picture information in lines of the programme signal to increase the brightness of the signal such that the darkening effect of adding the pulse, and the first and second modulated signals is reduced.

36. An apparatus according to claim 35 wherein the amplifier comprises:

a brightness separator for extracting a brightness signal from the received programme signal;

an analyser for analysing the brightness information and determining, in conjunction with information describing the receiver on which the modified programme signal is to be viewed, an amplification amount by which the brightness signal is amplified in the amplifier;

an forth adder, coupled to the first to third adders, for receiving the modified programme signal and adding to it the amplified brightness signal.

37. An apparatus according to claims 34 to 36 wherein the first adder is operable to add the pulse to the horizontal blanking interval adjacent the horizontal synchronisation pulse.

38. An apparatus according to claims 34 to 37 wherein the first adder is operable to add the pulse to the horizontal blanking interval such that the width of the horizontal synchronisation pulse is reduced.

39. An apparatus according to claims 34 to 38 wherein the first adder is operable to add the pulse with a height in the range 0.5V to 1.5V above the blanking level.

40. An apparatus according to claims 34 to 39 wherein the first adder is operable to add the pulse with a height of 1V.

41. An apparatus according to claims 34 to 40 wherein the first adder is operable to add the pulse with a width in the range 0.2μs to 4μs.

42. An apparatus according to claims 34 to 41 wherein the first adder is operable to add the pulse with a width of 1.2μs.

43. An apparatus according to claims 34 to 42 wherein the first adder is operable to position the pulse such that the width of the horizontal synchronisation pulse is reduced from 0μs to 2μs.

44. An apparatus according to claims 34 to 43 wherein the first adder is operable to position the pulse such that the width of the horizontal synchronisation pulse is reduced by 0.8μs.

45. An apparatus according to claims 34 to 44 wherein the first adder is operable to add the pulse to the horizontal blanking interval such that one or more of the height, the width, and the position of the pulse varies across the lines of the programme signal.

46. An apparatus according to claims 34 to 44 wherein the second adder is operable to add the first modulation signal having a frequency in the range 100kHz to 6500kHz.

47. An apparatus according to claims 34 to 45 wherein the second adder is operable to add the first modulation signal having a frequency of 400kHz.

48. An apparatus according to claims 34 to 46 wherein the second adder is operable to add the first modulation signal having a height that extends to 250mV above the blanking level.

49. An apparatus according to claims 34 to 48 wherein the second adder is operable to add a square wave as the first modulation signal.

50. An apparatus according to claims 34 to 48 wherein the second adder is operable to add a sine wave as the first modulation signal.

51. An apparatus according to claims 34 to 49 wherein the second adder is operable to add a saw tooth function as the first modulation signal.

52. An apparatus according to claims 34 to 51 wherein the second adder is operable to vary the frequency of the first modulation signal between different vertical synchronisation pulses.

53. An apparatus according to claims 34 to 51 wherein the third adder is operable to add the second modulation signal having a frequency in the range 10kHz to 2MHz.

54. An apparatus according to claims 34 to 52 wherein the third adder is operable to add the second modulation signal having a frequency of 220kHz.

55. An apparatus according to claims 34 to 53 wherein the third adder is operable to add the second modulation signal having an amplitude in the range 40mV to 150mV.

56. An apparatus according to claims 34 to 55 wherein the third adder is operable to add the second modulation signal having an amplitude of 70mV.

57. An apparatus according to claims 34 to 56 wherein the second modulation signal is a square wave.

58. An apparatus according to claims 34 to 57 wherein the third adder is operable to add a sine wave as the second modulation signal.

59. An apparatus according to claims 34 to 58 wherein the third adder is operable to add a saw tooth function as the second modulation signal.

60. An apparatus according to claims 34 to 59 wherein the third adder is operable to add the second modulation signal to between 5 and 15 lines of picture information prior to the vertical blanking section.

61. An apparatus according to claims 34 to 60 wherein the third adder is operable to add the second modulation signal to 12 lines of picture information prior to the vertical blanking section.

62. An apparatus according to claims 34 to 61 wherein the third adder is operable to add the second modulation signal such that at least one of the number of lines to which the second modulation signal is added, the amplitude of the modulation signal, and the frequency of the modulation signal is varied from frame to frame of the programme signal.

63. An apparatus according to claims 34 to 62 wherein one or more of the first to third adders add the pulse, and the first and second modulation signals to the programme signal in dependence on information relating to the type of receiver on which the programme signal is to be viewed.

64. An apparatus according to any of claims 35 to 63 wherein the amplifier is operable to add 100mV to the region of the signal comprising the picture information.

65. An apparatus according to any of claims 35 to 63 wherein the amplifier is operable to amplify the picture information by multiplying the region of the signal comprising the picture information by a scaling factor.

66. An apparatus according to any of claims 35 to 63 wherein the amplifier is operable to amplify the picture information by multiplying the region of the signal comprising the picture information by an amount that varies in dependence on information relating to the type of receiver on which the programme signal is to be viewed.

67. Apparatus for modifying a programme signal to provide protection against copying on a magnetic tape recorder, the apparatus comprising:

an input for receiving a programme signal divided into lines of information, the signal having horizontal synchronisation pulses and vertical synchronisation pulses for synchronising the programme on the screen of a receiver;

an output for outputting a modified programme signal; and any two of the following:

a first adder for adding a pulse into the programme signal during the horizontal blanking interval of lines that contain picture information and into lines in the vertical blanking region;

a second adder for adding a first modulation signal to vertical synchronisation pulses of the programme signal;

a third adder for adding a second modulation signal to lines of picture information in the vicinity of the vertical blanking region at the bottom of a frame of the programme signal; and

wherein the two of the pulse, and the first and second modulation signals added to the programme signal

are sufficient such that when the modified programme signal is copied by a magnetic tape recorder, interference is produced in the reproduction of the copied signal that is not visible in the reproduction of an uncopied programme signal.

68. A modified programme signal comprising divided into lines of information, the signal having horizontal synchronisation pulses and vertical synchronisation pulses for synchronising the programme on the screen of a receiver;

the modified signal comprising a pulse during the horizontal blanking interval of lines that contain picture information and into lines in the vertical blanking region, the pulse being in addition to the horizontal synchronisation pulse;

a first modulation signal in vertical synchronisation pulses of the programme signal;

a second modulation signal in lines of picture information in the vicinity of the vertical blanking region at the bottom of a frame of the programme signal;

wherein the pulse, and the first and second modulation signals are sufficient such that when the signal is copied by a magnetic tape recorder, interference is produced in the reproduction of the copied signal that is not visible in the reproduction of an uncopied programme signal.

69. A modified picture signal according to claim 2 comprising picture information in lines of the programme signal that is amplified in respect to a corresponding unmodified programme signal, the amplified picture information being sufficient to increase the brightness of the signal such that the darkening effect of the pulse, and the first and second modulated signals is reduced.

70. A method as substantially described herein with reference to Figures 2 to 6 the drawings.

71. An apparatus as substantially described herein with respect to Figures 2 to 6 of the drawings.

72. A modified programme signal as described herein with respect to Figures 2 to 6 of the drawings.

(Fig 3)

ABSTRACT

A anti-copy programme signal is provided. Copies of the anti-copy video pulses made on a video recorder experience reduced quality and interference in playback making them unpleasant to watch. The uncopied signal can be viewed without any material effect on picture quality.

The signal comprises a pulse 28 added to each line 6 of the signal throughout both the visible picture region and throughout the vertical blanking region 12, as well as a first modulated wave-form 34 added to the vertical synchronisation pulses 16 of the signal and a second modulated wave-form 36 added to several lines 6 of the picture signal before the vertical blanking section 12.

The presence of all three of these features together has been found to be provide a surprising accumulative effectiveness in causing interference in the reproduction of the modified video signal during playback of the copied video signal, that is greater than the effectiveness provided by the different features taken separately.

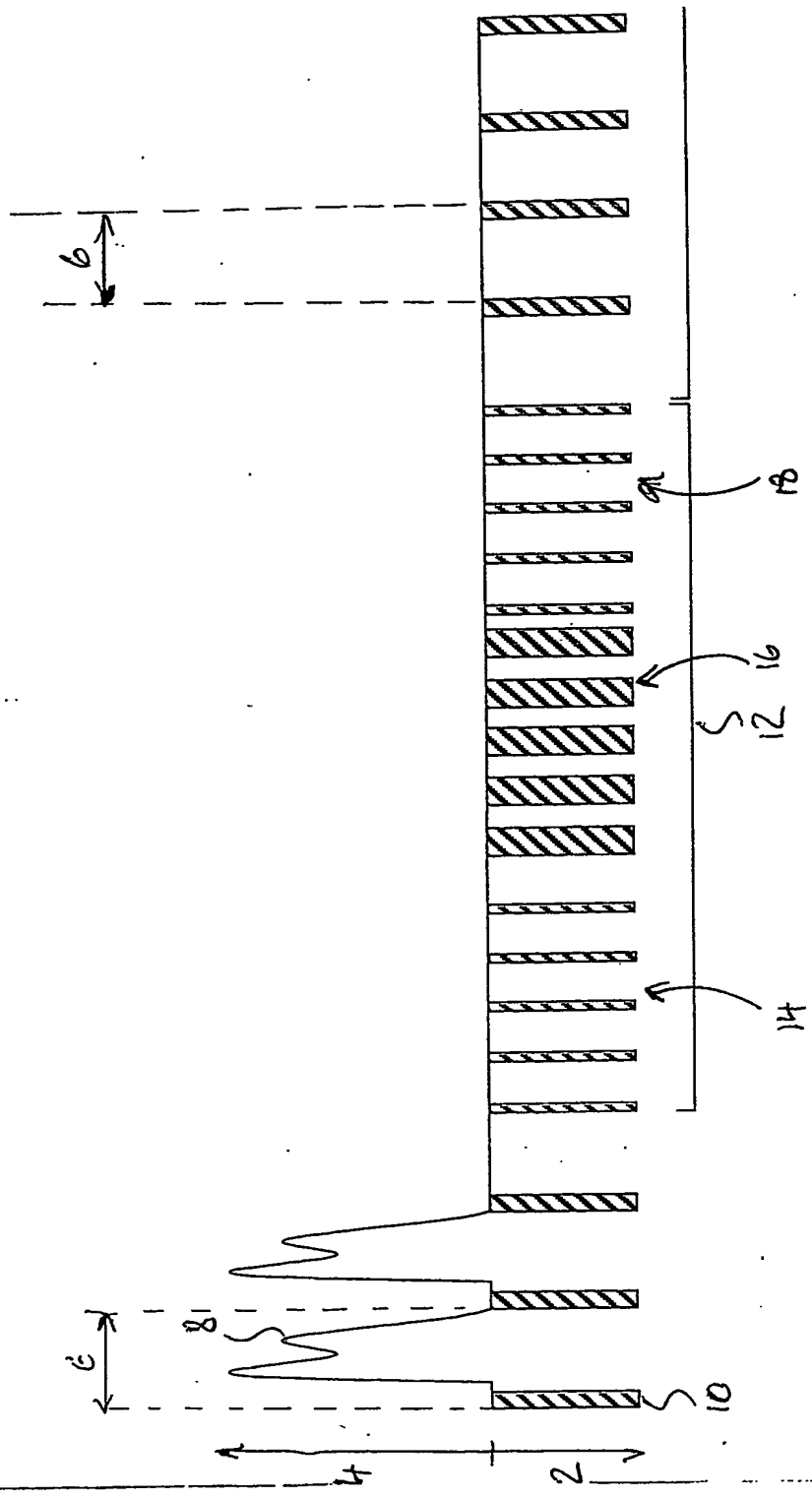


Figure 1

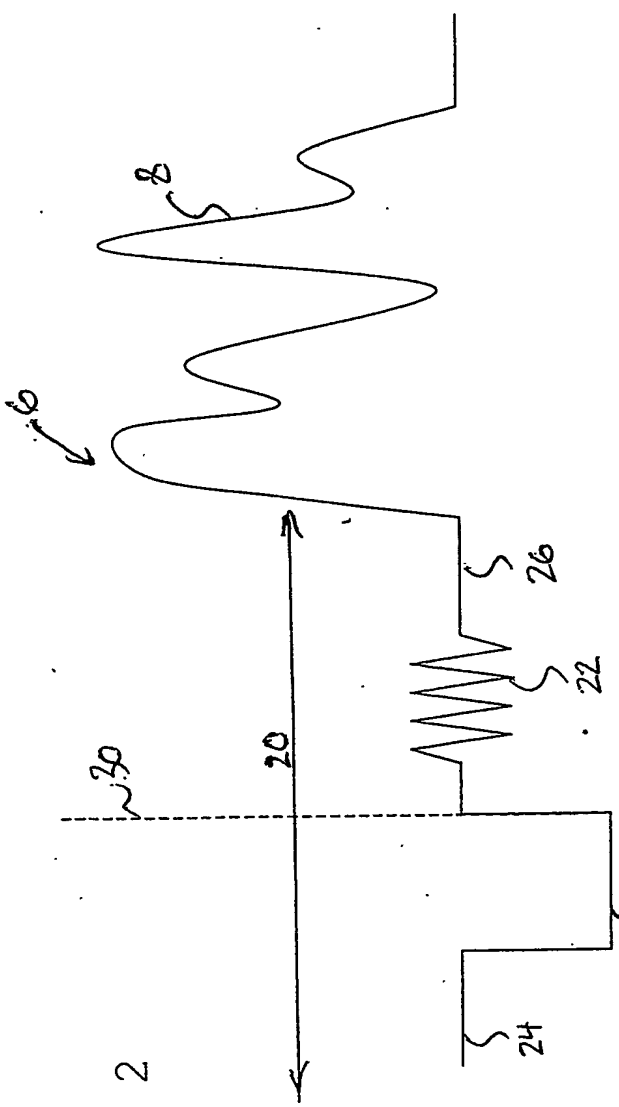


Figure 2

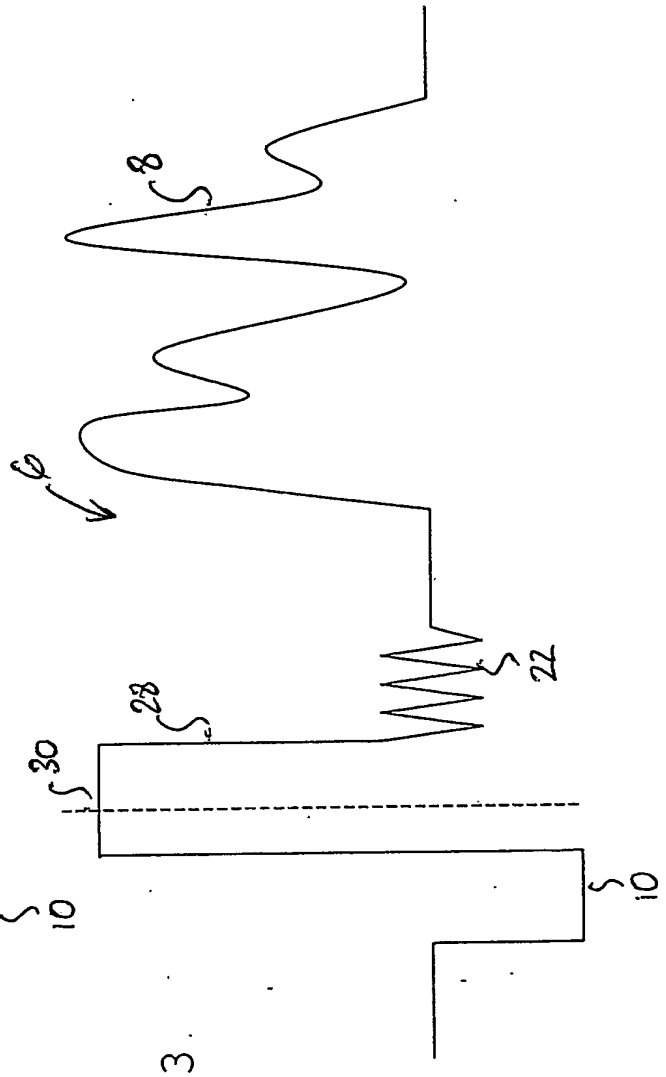


Figure 3

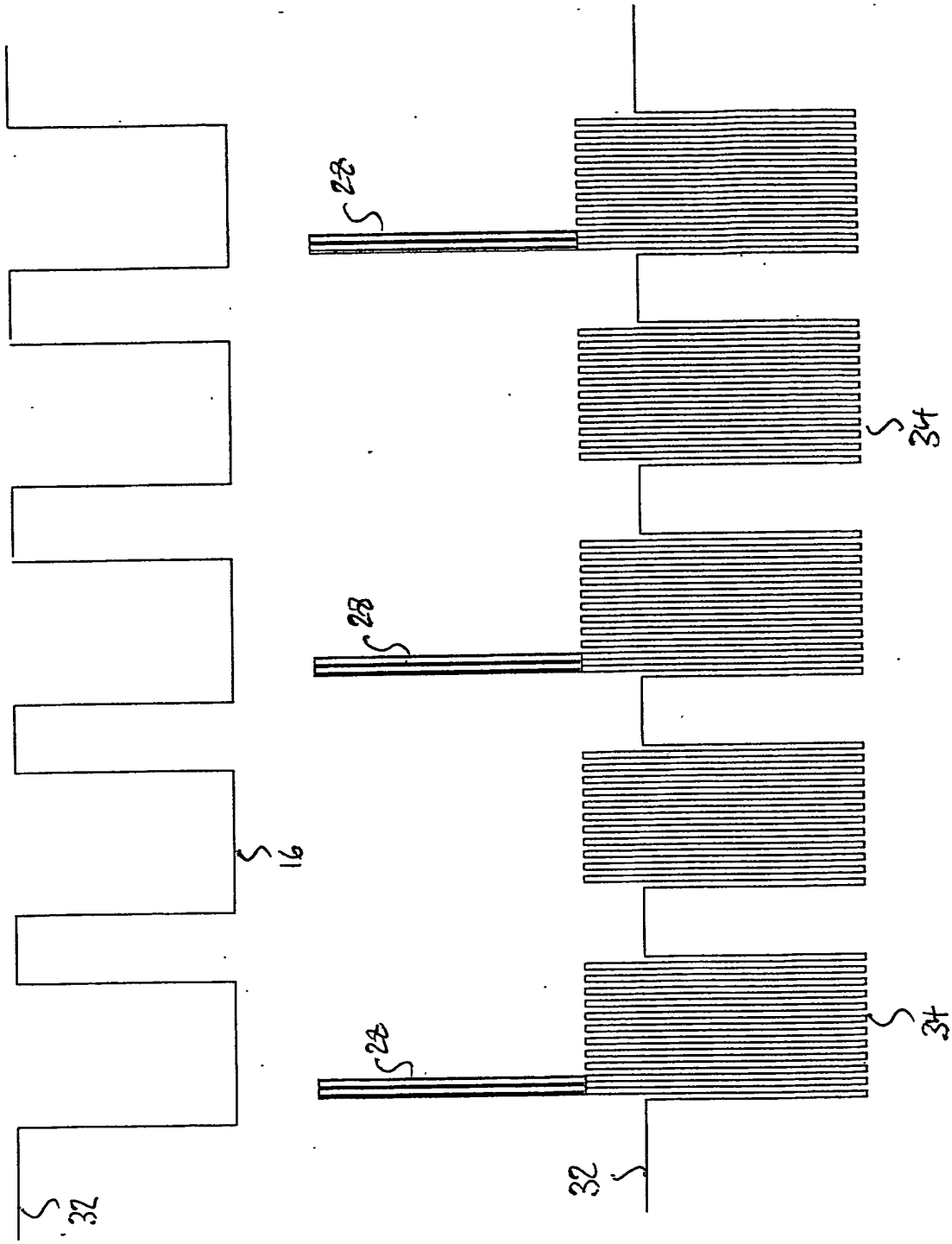
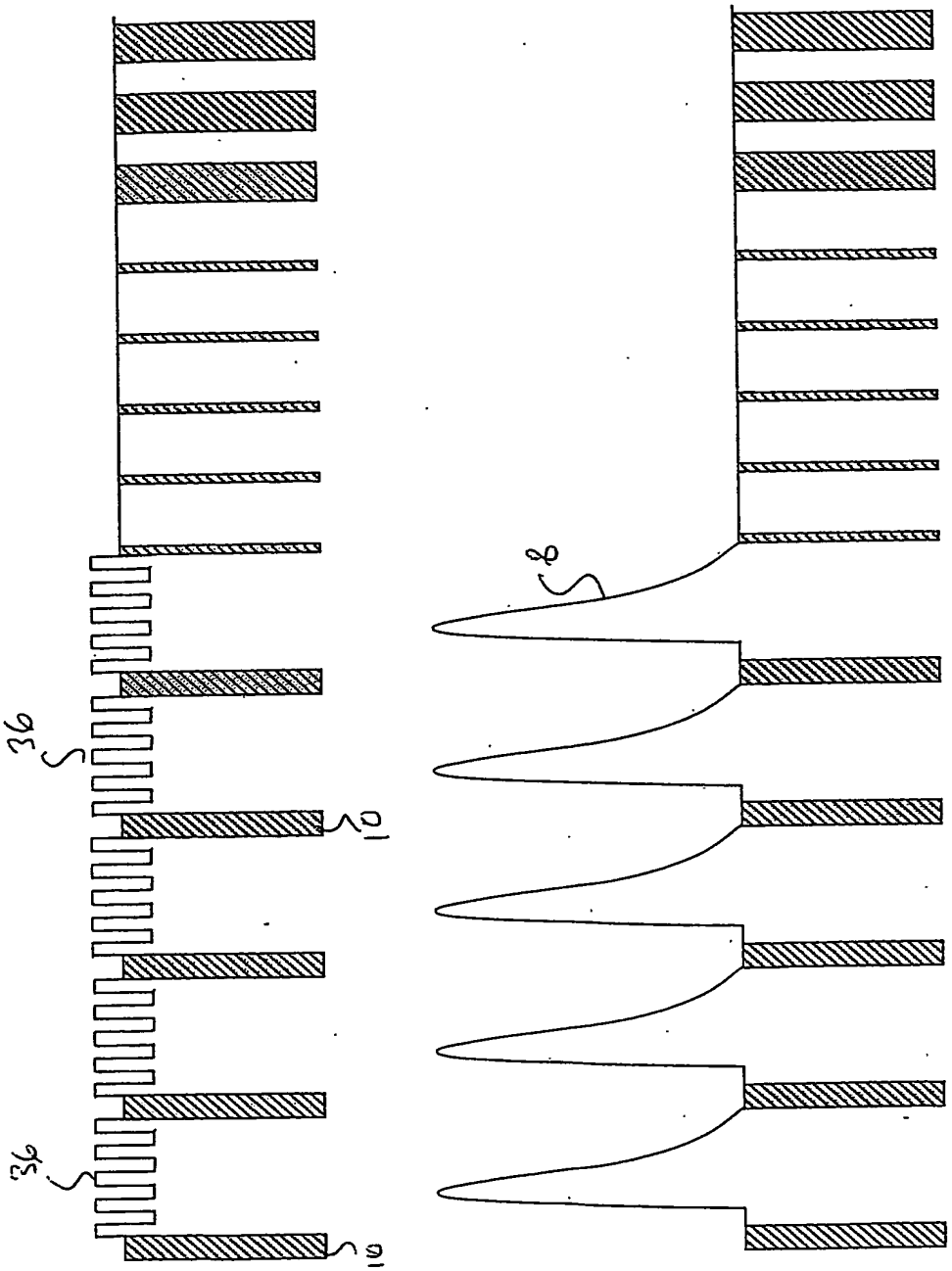


Figure 4

Figure 5



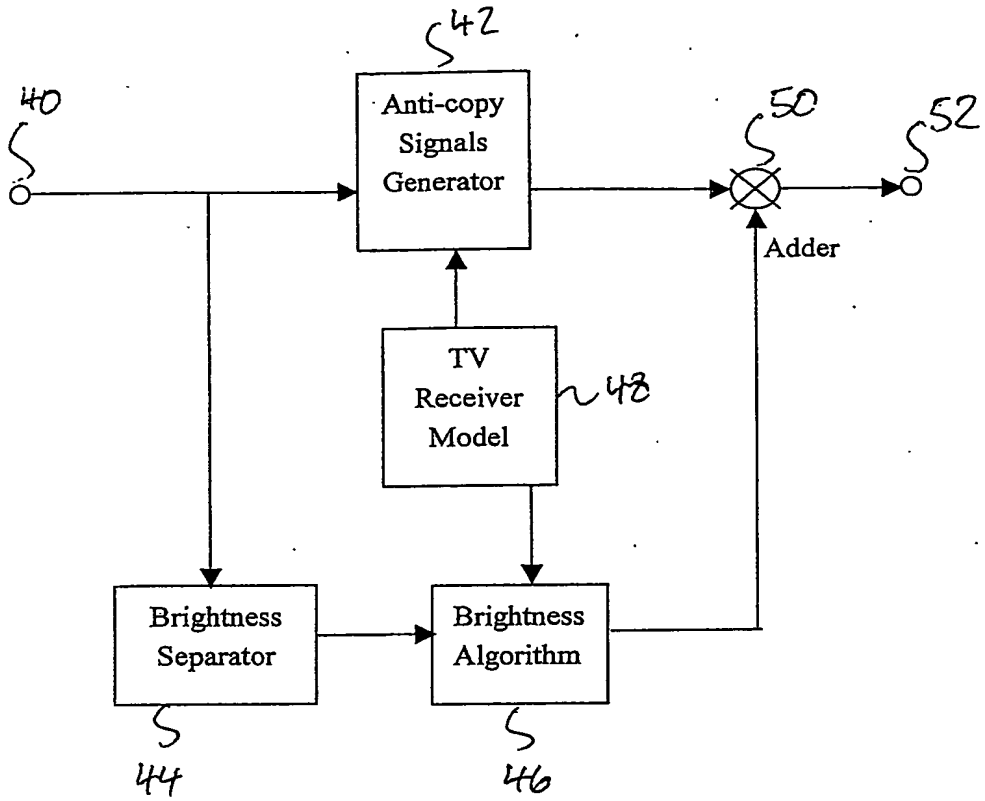

42
40
Anti-copy Signals Generator
50
52
Adder
TV Receiver Model
48
Brightness Separator
Brightness Algorithm
44
46

Figure 6